Research methods on the Internet

Book Section

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Claire Hewson

The Open University

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This chapter considers how the various internet communication technologies discussed in Section I can and have been used to support, and arguably transform, social and behavioural research methods. Focus here is on *primary research*, that is, "the acquisition and analysis of data to produce novel evidence and research findings" (Hewson, Laurent and Vogel, forthcoming). Primary research on the internet has been referred to as internet-mediated research (IMR) (Hewson et al. 2003) and this term will be adopted throughout the present chapter. The chapter will not consider secondary research on the internet, such as conducting a literature review or creating a bibliography; for useful guides on the latter see Hewson et al. (2003); Ó Dochartaigh (2012). The structure of the chapter is as follows: overview and history of IMR; scope and range of IMR methods, with illustrations; key issues and debates in IMR (data quality, sampling, ethics); future possibilities and directions.

1. Overview and History of IMR

The birth of IMR can be traced back to the early 1990s when researchers from a

variety of disciplines and backgrounds started to pilot a range of techniques, most notably survey and interview approaches, experiments, and observational research. Over the last two decades the growth and diversification of IMR has been quite astounding. Supported by the parallel growth of internet technologies and the internet user population, the present scope, use and potential of IMR methods is now vast. To illustrate the extent of these developments, consider the early examples which used technologies such as email to administer surveys (Dillman 1991; Dommeyer and Moriarty 1999), interviews (Murray and Sixsmith 1998), and experiments (Hewson 1994). Email approaches were attractive at the time due to not requiring sophisticated computer programming and server configuration skills. Researchers wishing to use more sophisticated techniques, such as web-based surveys and experiments, were required to engage directly with programming code, or have access to support teams which could carry out these implementations. That involved working with HTML code, javascript, server-side scripts, and so on. Although a number of early guides emerged to assist the interested researcher in getting to grips with such programming techniques (e.g. Birnbaum 2000; Hewson et al. 2003), there was clearly a bias in these early days towards the more computer- literate and interested researcher amongst those engaging in piloting IMR methods. One major development since then has been the impact of technologies in expanding both the range and accessibility of IMR methods. For example, there now exists a wide range of online survey software solutions which offer relatively easy-to-use options for administering surveys via the world wide web (e.g. SurveyMonkey: surveymonkey.com; Qualtrics: qualtrics.com); some of these packages now also embody optimisations for mobile delivery (e.g. for delivery via smart phones). Similar packages for assisting in implementing web-based experiments exist, though these are far fewer and certainly more technically challenging to use, with different solutions differing on their ease of implementation. For

example, WEXTOR offers a fairly friendly web interface for designing and creating web-based experimental designs (see: http://wextor.org/wextor/en/), whereas WEBEXP (see: www.webexp.info) requires more advanced computing skills to set up and use, including hosting a web server. Technological changes have also facilitated the accessibility of other methods, such as unobtrusive observation approaches which gather data from existing online sources such as discussion group archives; many discussion groups these days can be accessed by a user-friendly web interface, rather than requiring a newsreader application and subscription to this and downloading of messages. Some of the state-of-the-art technologies presently available for supporting a range of IMR methods will be discussed further below, as each of these methods is considered in more detail.

A second major development in the history of IMR is the recent expansion and explosion of unobtrusive data collection approaches, variously referred to as 'data-mining', 'data-scraping', and 'data harvesting'. Many of these approaches may be described as 'unobtrusive observation techniques', others as document analysis. The distinction between observation and document analysis in this context can become blurred, but a useful working definition is that observation involves sourcing data from people's *interactive* behaviours online (intra- and inter- personal), whereas document analysis involves sourcing data from static, finished, published products. Examples of both types of data sources are presented in the next section, to illustrate. These techniques can lead to the creation of 'big data' sets, i.e. data sets which are so large that they are difficult to store, manage and analyse. Techniques for presenting the results of analyses of such data sets often rely on graphical methods, where complex patterns connecting a large array of 'nodes' (which act as data points) are offered.

Thirdly, developments in the growth and diversity of the internet-user population (IUP) over the last several decades have played an important role in expanding the scope of

the internet as a site for conducting social and behavioural research. Sample bias was an early major concern in IMR (e.g. Schmidt 1997; see further discussion below), but many recent studies have indicated that data generated from samples recruited online can produce high quality, reliable data comparable (or even superior) to that generated offline. Statistics on the expansion and diversity worldwide of the IUP support the idea that the internet now enables arguably unprecedented access to a vast, diverse pool of potential participants (some recent figures are presented below under sampling).

2. Scope and Range of IMR Methods

Internet-mediated research methods have now expanded to create a diverse, cross-disciplinary, comprehensive array of techniques and procedures from different research traditions (notably, both qualitative and quantitative) spanning a variety of research domains. Most popular, accessible and widely used is the online survey or questionnaire (e.g. psychometric scale). Looking at a few of the online survey clearing houses presently residing on the web indicates the breadth and scope of this mode of data collection in IMR, though there is a clear bias towards psychological research in the existing resources available, which are often hosted by psychologists or psychological organisations (e.g. see: Online Psychology Research: www.onlinepsychresearch.co.uk). The IMR survey literature clearly indicates, however, that other disciplines have used online survey methods (e.g. sociology: Valliant and Dever 2011; politics: Malhotra and Krosnick 2007; nursing studies: AbuAlRub 2006). This expansion in the use of online surveys has been noted by some as a reflection of the 'democratisation' of the survey (e.g. Couper 2000), for example allowing researchers who may otherwise have lacked the necessary resources (i.e. time, funding, research assistance) to conduct survey-based research (Carter-Pokras, McClellan and Zambrano 2006). Others, on the other hand, have raised concerns regarding the potential for numerous poorly designed

surveys to appear online which could damage the reputation of online surveys, similarly to the impact that telemarketing had on the reputation of telephone surveys (Fielding, Lee and Blank 2008).

Other key methods which have now become established in IMR are: experiments, interviews, observational approaches, and (though there are fewer examples) document analysis. Examples of each of these approaches are given in this section. Again, these methods have spanned a range of disciplines and research orientations, with some methods appearing more prominently in certain areas and domains, e.g. experiments have been particularly common in cognitive psychology research. A useful framework for thinking about the array of IMR methods presently being used, and for classifying these, is proposed by Hewson, Laurent and Vogel (forthcoming). They consider the 'obtrusive-unobtrusive' dimension as effective for distinguishing different types of IMR methods, noting that this distinction can help clarify how different issues, e.g. the ethics concerns that can arise, may map on to this dimension. Essentially, obtrusive methods involve participants actively engaging in research procedures in the knowledge that they are taking part in and contributing data for a research study, while unobtrusive methods gather data without such awareness by participants. Naturally, in considering this distinction as a dimension rather than a dichotomy, particular methods will tend to be 'more' or 'less' obtrusive or unobtrusive, rather than being clear cut instances of either category. Hewson et al. (forthcoming) position different methods along the obtrusive-unobtrusive dimension based on how they have typically been implemented, each method spanning a range of conceivable possible positions (depending on the particular design and implementation choices made). For example, interview and survey methods are (necessarily) obtrusive, though perhaps more or less so depending on whether e.g. a synchronous or asynchronous interview is conducted. Document

analysis tends to be unobtrusive (unless, perhaps, documents are solicited), and observation methods have spanned most broadly the whole range of the dimension (more recently, data mining techniques have expanded the scope and prevalence of approaches very much towards the unobtrusive end).

Now, illustrations of each of the key methods in IMR mentioned above will be considered, along with an outline of the tools and techniques which have enabled their implementation. In the next section, some of the key issues which have emerged in IMR more generally will be considered, with reflections on how these issues might relate in particular to the methods that have been discussed in this section.

2.1 Surveys and Questionnaires

The majority of surveys and questionnaires administered online are now web-based, facilitated by the many cost-effective, user-friendly software packages now available to support this method. Different packages offer different ranges of functionality, and vary in price and levels of support offered; see the WebSurveyMethodology (WebSM) resource (websm.org) for a useful, searchable database of the many packages presently available. SurveyMonkey has been a particularly popular option with UK-based academic researchers, though Qualtrics is now starting to reach the UK market, having become well-established as a popular option at US universities. Qualtrics is appealing in offering competitively priced department, faculty and university-wide licenses (prices for the last two options negotiated individually with universities, depending on their needs). Both packages are good examples of user-friendly interfaces offering reliability, and a reasonable range of functionality for low to mid prices options. Email-based surveys are still used (e.g. Bigelsen and Schupak 2011), though are not very common these days. One of the key advantages of web-based (as

opposed to e.g. email) approaches in IMR survey methods is the scope for maintaining greater control over presentation and other procedural parameters, as well as the potential enhanced functionalities that can be integrated. Thus, maintaining consistency of factors such as font size, page layout, order of presentation of questions, and so on is easier to achieve using web-based survey methods. Now, most packages are careful to implement measures that maximise consistency of display across different browsers. Additional features which web-based methods can readily support, compared with email, include skip logic (moving to particular subsequent questions depending on participants' answers to previous questions), question piping (customising later questions using text entered by participants in earlier responses), and checking for response completeness and correct format. This gives web-based approaches a big advantage when it comes to considerations of flexibility, consistency, reliability and validity (see further discussion of data validity below).

Examples of web-based survey research have illustrated how both extremely large sample sizes, and specialist difficult-to-reach populations can be obtained fairly time and cost effectively. Thus Reece et al. (2010) report obtaining a sample of 25,294 gay and bisexual men who completed a survey on sexual behaviours. Their recruitment methods involved sending emails directly to members of a popular internet social and sexual networking site for men seeking men (see below for further discussion of sampling in IMR). In this case both a very large, and relatively specialist sample was achieved. Bigelsen & Schupak (2011) report successfully obtaining a particularly specialist, hard-to-reach population, which they note would have been difficult to obtain using offline methods, in their study of people who identified as excessive or maladaptive fantasisers. They managed to recruit a sample of 90 self-identified excessive fantasisers. In this case, a questionnaire was sent for completion and return by email. Another example in which a specialist population was obtained is reported

by Anderson et al. (2003) who recruited 157 tinnitus patients, who after a screening test were administered questionnaires either offline or online; the online recruitment methods involved posting requests to the webpages of the Swedish Hard of Hearing Association (offline newspaper recruitment adverts were also used).

A very common use of online survey and questionnaire methods has been to administer psychometric test instruments. Often, these implementations are carried out in the context of 'validating' a particular existing psychometric scale for use online, since porting such tests to an online medium alters the testing context and conditions (e.g. participants are unsupervised, procedural and presentation details can differ slightly, etc.), and thus psychometric test properties and norms established offline cannot be assumed (see below for more discussion of IMR validation studies). The aforementioned study by Anderson et al. (2003) adopted this approach, reporting comparability of the Hospital Anxiety and Depression Scale (HADS) for administration both online and offline to tinnitus sufferers. Another example is presented by Hewson and Charlton (2005) who administered the well-utilised Multidimensional Health Locus of Control Scale (MHLC) (Wallston and Wallston 1981) online, noting that while many studies had demonstrated the validity of unidimensional tests for online administration, few had reported results for multidimensional scales. They found the properties of this scale to be at least as good as when administered offline (which they did concurrently in the same study). Still, as Buchanan and Smith (1999) have pointed out, finding that one psychometric scale seems able to be validly administered online does not allow generalisations to other scales; each scale needs to be validated independently for porting to an IMR setting.

Marketing and consumer research have also enjoyed a flurry of activity in the online survey arena (Grandcolas et al. 2003), the method being a quick, effective way to obtain

commercially valuable data from a potentially large number of participants. This area is one where the aforementioned concerns regarding the quality, integrity and 'image' of online survey research may be most pertinent (many readers will be familiar with the marketing survey pop-up boxes that can sometimes become quite annoying when trying to use the world wide web). Crucial to minimising such possible influences on academic social and behavioural research is to implement and present well-designed surveys which adhere to principles of good practice, including ethics procedures (see more on ethics below). Fortunately there are plenty of resources now available on good practice in online survey design and implementations. A particularly helpful resource for researchers wishing to explore possibilities for implementing IMR surveys is the *Web Survey Methodology* website (WebSM: www.websm.org). There are also now several books dedicated to the topic (e.g. Couper 2008; Sue and Ritter 2012), and the more generic online research web resource *Exploring Online Research Methods* (www.restore.ac.uk/orm/) which provides some very useful training and teaching materials on web and other online (e.g. email) survey approaches.

2.2 Interviews and Focus Groups

Researchers have been conducting interviews and focus groups in IMR since the very early days (e.g. Gaiser 1997; Murray and Sixsmith 1998). However, this IMR method has not taken off in quite the same way as others, particularly the online survey. It is useful to distinguish between *asynchronous* and *synchronous* methods for conducting IMR interview-based research. Asynchronous methods typically use email (or perhaps discussion group technologies) and involve a longer timescale, conversants (interviewer and interviewee) sending exchanges back and forth as and when it is convenient. A number of researchers have reported success in using this approach, and noted several benefits, including the extended

timescale (e.g. compared with an offline face-to-face [ftf] interview) enabling more time for reflection and 'fact-checking' (compared with relying on memory). Also, it has been suggested that such approaches can help balance out power relationships between researcher and interviewee, due to the greater control over the timescale of the interview delegated to the interviewee (Madge and O'Connor 2002). Synchronous approaches have been less well-used, on the whole, perhaps hindered by less successful reports from some of the early attempts at implementing these, but also possibly due to the requirement to engage with more advanced, less widely used 'chat' technologies which are required to enable these approaches (O'Connor et al. 2008).

Compared with traditional offline ftf interviews, the nature of the online communication medium – which typically supports *text-based* exchanges (as in the above described approaches) – has been noted as presenting both possible benefits, and possible drawbacks, in IMR approaches. Thus, a key consideration has been how the lack of normally present visual and extralinguistic cues available offline may impact upon the quality of the data obtained in an online interview, particularly the 'richness' of the data, and the levels of detail, accuracy and reflexivity that can be achieved. These issues have been linked to the lack of proximal contact with participants in IMR contexts making it more difficult to establish good levels of rapport (Jowett et al. 2011), as well as the possible ambiguities that may arise where normally available cues such as intonation, body language, facial expression, etc are absent. There have been mixed reports to date from online interview researchers regarding the effects of the online medium on data quality, richness, reflexivity, clarity, and so on. Notably, in relation to the aforementioned synchronous-asynchronous distinction, the majority of successful reports to date seem to have come from researchers using asynchronous methods (Bowker and Tuffin 2004; Kenny 2005; McDermott and Roen

2012). Synchronous approaches have more often been reported as tending to generate less detailed, flippant, or playful responses (Davis et al. 2004; Gaiser 1997). Having said this, there have been suggestions that synchronous approaches may have the advantage of being better able to maintain 'conversational flow' (Hewson 2008). That is, the potentially lengthy breaks between question and response in an asynchronous email interview, for example (which could involve days), could make it difficult for conversational partners to maintain continuity and coherence in the themes of the conversation, particularly where larger groups are involved (such as in a focus group). In this sense, synchronous approaches could offer an advantage. However, the reliance on all participants being together at the same time creates an obvious restriction for such methods. Asynchronous approaches offer more scope for bringing together participants from a diverse range of geographical and time zone locations (though Gaiser 2008, has also noted the potential difficulty for a researcher in managing asynchronous focus groups where participants are widely geographically dispersed and in different time zones).

The lack of proximal contact in the online interview, and resulting effect of reduced availability of cues which may normally be available (i.e. in ftf contexts) to help enrich and disambiguate data, may on the other hand have possible benefits. Thus the potentially enhanced levels of anonymity in an online interview context, alongside the scope for engaging in quite elaborate and intimate exchanges, has been noted as opening possibilities for strategic, deliberate attempts to try and reduce the impact of biosocial factors (sex, class, race, etc.), which could otherwise lead to unwanted biases (Hewson et al. 2003). However, in general, interview researchers have tended not to emphasise and test such possibilities, striving rather to employ strategies and procedures for reducing levels of perceived anonymity as far as is possible. For example, several researchers have emphasised the

importance of using carefully constructed 'rapport-building' exercises, for example involving personal self-disclosure on the part of the researcher, so as to create a 'bond' with participants and encourage rich and candid exchanges (Madge and O'Connor 2002). Indeed, some researchers have reported very successful outcomes when adopting such techniques, even using synchronous approaches (which as noted earlier, have generally been less successful) (Barratt 2012; Madge and O'Connor 2002). Nevertheless, there is some evidence that enhanced levels of anonymity in online communications can encourage more candid, less socially desirable responses (Joinson 2005). The extent to which striving to capitalise on such possible advantages of enhanced levels of anonymity in online contexts, or adopting strategies to reduce anonymity and enhance rapport, will prove most beneficial in IMR interview approaches requires further exploration. To date, it seems that rapport-building strategies have been shown to be especially important and beneficial. Other methods (e.g. surveys) may find higher levels of anonymity especially advantageous.

One possibility for creating an online interview context that perhaps most closely approximates offline ftf approaches, and allows extralinguistic information to be utilised, is to use multimedia technologies, such as Skype. Hanna (2012) has piloted this approach, conducting one-to-one interviews with participants using Skype. However, presently such approaches are hampered by issues of low reliability in audio and video quality, and risks of losing connections, due to present technological constraints. The emergence of better and faster internet technologies and connection (download and upload) speeds may well improve these issues in the near future. Though it is worth also noting here that there is some evidence that the aforementioned benefits of online communication modes for enhancing candour and disclosure may apply only to visually anonymous computer-mediated communication (CMC) contexts (Joinson 2001).

2.3 Experiments

Like surveys, IMR experiments concur many advantages from being implemented via the world wide web, most notably due to greater levels of control over a range of parameters, compared with other possible methods. In many cases the more complex requirements of experimental designs, compared with online surveys, e.g. implementing timings, maintaining control over variables that must crucially remain constant, and so on, demand web-based implementations. However, in simple designs other approaches are possible. For example, Hewson (1994) reports an early experiment in which the experimental manipulation involved presenting participants with different versions of a vignette, and associated questions which elicited responses. It was thus possible to send the experimental materials in the body of an email, and ask participants to send their responses back by email. While a web-based implementation would certainly have had the advantage of allowing greater control over various parameters (see Hewson 2003, for a more detailed 'case study' discussion), the email-based procedure did generate valuable data which allowed the research questions to be answered. Now that there exist software packages to assist in web-based experiment implementations (see above), it is easier to construct these than in the early days when first-hand programming techniques and web server management were necessary. That said, these tools still require a level of computer-related expertise and / or commitment to use, and cannot be so easily adopted by anyone who has only modest levels of web browser and basic software use skills, as can online survey packages. However, in some cases survey packages might be used to implement relatively simple experimental designs, especially those packages which include random assignment of participants to conditions amongst their range of functionalities (e.g. SurveyMonkey 'Gold').

There now exists a good range of examples of web-based experiments, and several

very useful guides on resources and design issues, as well as principles of good practice to bear in mind (Reips 2000; Reips and Krantz 2010). Much of the existing work using these methods has come from areas of psychological research, particularly cognitive psychology (as may be expected). Simple text-based materials are the most easy to implement (e.g. Pohl et al. 2002), whilst experiments incorporating graphics, audio, video, and precise timings introduce various increasing levels of complexity. Recent technological advances, including wider access to faster internet upload and download speeds, has facilitated the use and plausibility of these more complex implementations. For example, whereas several decades ago it seemed that implementing reaction time experiments in IMR which required precise timings (i.e. to the millisecond, as in much psycholinguistic research) was not feasible, researchers have since successfully carried out such studies (e.g. Corley and Scheepers 2002). Likewise, experiments involving the download of large-sized multimedia files were far less plausible in the early days, but have now been successfully demonstrated as possible. Thus Caro et al. (2012) conducted an experiment in which elderly participants were presented with video clip vignettes via the internet, in order to explore their views on residential options, including their choices when confronted with health and disability challenges. The study in this case was set up using bespoke software, and most participants took part in a supervised setting, though the researchers note that this would not have been necessary if the population of interest had not been relatively inexperienced in using computers. Though setting up the experiment for Internet delivery involved a number of technical challenges, it ran smoothly; the authors note that such video-delivery implementations in IMR should become more widely accessible to researchers in the future as appropriate technological solutions become more readily available.

Finally, experiments in IMR need not necessarily involve a single participant

interacting with a computer program, but may potentially support designs allowing interactions between several participants simultaneously. Of course, this adds yet another layer of complexity, but there are already some examples of this type of approach, showing this it is indeed possible. For example, Horton, Rand and Zeckhause (2011) recruited participants from the online labour market 'Mechanical Turk' (www.mturk.com/mturk/) to take part in interactive experiments using the prisoner's dilemma paradigm, and replicated results previously found in offline contexts. They do, however, note that the present lack of availability of advanced, dedicated software for implementing these types of designs means bespoke solutions are still necessary. One set of technologies presently available which may provide a more accessible way of implementing interactive experiments in IMR is 'multi user virtual environments' (MUVEs). While there will clearly be limitations on what can be achieved using these environments, due to a lack of flexibility compared with what can be implemented using bespoke options, they may prove useful for some purposes, and potentially support some research designs (see Shroeder and Bailenson 2008, for a discussion of MUVE research; see also below for consideration of observational studies which use MUVEs and MUSEs [multi user simulated environments] and which overlap with experimental designs).

Given the inevitable greater complexity involved in implementing IMR experimental designs, as well as the enhanced need (compared with many other methods) for maintaining tight control over variables, this IMR method had generated a greater emphasis within the relevant literature on the details and intricacies of various design and implementation choices, particularly in terms of their potential effects on participants' responses, who volunteers to respond, and so on. For useful discussions of such methodological issues see Reips and Krantz (2010), Krantz and Williams (2010). Useful principles of good practice for IMR

experimental design have been offered, such as using the lowest-tech solutions to achieve what is required (Reips and Krantz 2010) and making participants aware of any requirements for particular specialist software which cannot reasonably be assumed to be in widespread use (Hewson et al. 2003).

2.4 Observation and Document Analysis

Observation approaches in IMR have recently been of particular interest, largely in response to Web 2.0 developments and the accompanying increasing widespread recognition of the wealth of potential data now available in the form of traces of inter- and intra- person activity online (Hewson forthcoming 2014). The range of approaches being conceptualised and implemented has expanded dramatically over the last decade or so. Both obtrusive and unobtrusive observational methods in IMR have now been applied across a broad array of research domains within different disciplines. An early example of an unobtrusive observational study which demonstrates some of the particular benefits of an IMR approach is presented by Bordia (1996). Bordia was able to locate and extract examples of rumour transmission from Usenet, Internet and Bitnet newsgroups, allowing investigation of this topic in a way that could not be easily achieved using offline methods; in particular the ability to effectively search and locate instances of rumours enabled more data to be generated than would typically have been possible offline, and the online medium facilitated the possibility of doing this unobtrusively (reducing data contamination from demand characteristics present in disclosed observational approaches). More recent examples involving the observation of traces from online discussion forums include Brady and Guerin (2010) who accessed archives of an online parenting support group website and subjected these to qualitative analysis. Being able to gain ready access to a vast, diverse collection of discussion archives online, and easily search these for specific topics and content, is a particular feature of IMR approaches

which does not have an obvious parallel in offline observation research. Access to such discussion groups is possible using services such as the web-based interface Google Groups (groups.google.com).

Since the earliest text-based examples, observational IMR studies have expanded in scope, moving on to also incorporate multimedia sources (graphics, audio, video, etc.), drawing upon possibilities offered by Web 2.0 technologies. One relatively accessible approach is to use Social Networking Sites (SNSs), such as Facebook, and media sharing services (e.g. YouTube, FlickR, etc.) as platforms for gathering multi-media observational data (the latter perhaps being better suited to supporting document analysis approaches, depending on the nature of the particular sharing service). McCreanor et al. (2013) offer a review of studies which have explored the way in which alcohol marketing companies have used SNSs to promote their products. Such marketing via SNSs has raised concerns recently about the potential damaging effects on young people of exposure to alcohol marketing and pro-drinking messages on the Internet (e.g. see the recent 'Alcohol Concern' report on this topic: www.alcoholconcern.org.uk/publications/policy-reports/new-media-new-problem). Observational studies which interrogate the structure, function and content of these SNSs is thus of value in gaining insights into young people's alcohol-related attitudes and behaviours. A study by Yoo and Kim (2012) used YouTube (a media sharing website where people post up videos, and others can comment on these; see: youtube.com) in order to access and analyse videos which depicted obesity-related content, so as to explore the portrayal of obesity themes, and obese people, within this online medium.

Virtual Reality Environments (VREs), including MUVEs and MUSEs, have also been used in observational IMR. A very early example of this approach is presented by Givaty et al. (1998) who asked participants to navigate around a 3D virtual environment, created

especially for the research study, in an investigation of aspects of visual cognition; these authors note the benefits of the IMR environment in allowing more participants to be obtained compared with offline supervised laboratory settings. Williams (2007), on the other hand, made use of an existing virtual environment (*Cyberworlds*) to conduct an ethnographic study in which he observed avatars, one of the reported benefits being the ability to readily record detailed field notes covertly. Using existing VRE resources in this way is generally likely to place lower technical skill demands on the researcher. Other well-known VREs that could potentially serve as a platform for such designs include SecondLife (secondlife.com). Schroeder and Bailenson (2008) review IMR approaches which have used VREs, many of which have involved computer science and educational applications, and utilised experimental designs. Experimental approaches (often overlapping with observation approaches) in VRE research hold particular promise due to the ability to manipulate and maintain close control over variables. Also, the facilitation of unobtrusive observation in such environments, as well as the ability to automatically record behaviours (of avatars), is of particular note.

The examples discussed above have for the most part involved observations of the 'content' of online interactions and behaviours, e.g. what people have said in discussion posts, in YouTube videos, while interacting in virtual environments, their responses recorded in experimental tasks, and so on. One interesting feature of people's interactions and behaviours online is the potential for (and often automatically occurring, e.g. in web log files) logging of details of the processes, structures and patterns of these interactions. For example, webpage navigations, search engine terms entered, Facebook status 'likes', and social network 'friend links' are all data forms involving the patterns and processes of online interactions. Such traces can be harvested (with a bit of technical know how) to be used in

various imaginable research projects. Within the social and behavioural sciences, discussions of how such 'big data' sets (i.e. they often have scope to be extremely large) may be useful to a range of research domains and topics have only recently started to emerge. Marketing research is a domain where the approach has perhaps been most prevalent to date, companies finding data on customers' navigations of their webpages, e.g. searching and purchasing behaviour, to hold obvious commercial and marketing value. Indeed, Google Analytics (www.google.co.uk/analytics) provides a service to assist in collecting and analysing such data from webpage browsing activity. While social science applications remain largely to be explored, one domain in which online unobtrusive observation of this nature has had an impact is social network analysis (SNA). Essentially, SNA involves tracing and tracking the patterns, structures and movements of social groups and communities (and has been a thriving area of research offline). In an IMR context, the large volumes of data which can potentially be harvested from social networking sites has presented opportunities for bringing SNA techniques and methods to the online medium. Thus, data concerning who has 'friended' who, who has messaged who, which friends post on each other's walls, etc. may conceivably be of use. For a description of SNA in IMR see Hogan (2008).

Techniques such as SNA which involve collecting large volumes of process and pattern data do involve more technically complex procedures than many of the other IMR methods discussed above, typically requiring 'data scraping' algorithms to be created. Also, the analysis and presentation of such data can present technical challenges. However, some tools to assist in the collection of such data sources are starting to emerge. For example, Webometrics Analyst is a free software tool designed to help in producing network diagrams based on web searches of sources including Twitter and YouTube (see: http://lexiurl.wlv.ac.uk/index.html). Unfortunately this is a Windows-only resource (hence the

author, a Mac-user, has not been able to try it out). Other potentially useful resources include Google's ngam viewer (see: https://books.google.com/ngrams). A dedicated tool for searching Twitter has been created by Ulf-Dietrich Reips, and can be located here: http://maps.iscience.deusto.es. The role of big data sets obtainable online in social science methods is a current thriving discussion topic. For further information see the current project on this topic being run by the Oxford Internet Institute: *Accessing and Using Big Data to Advance Social Science Knowledge* (www.oii.ox.ac.uk/research/projects/?id=98).

Document analysis approaches, as noted above, can be broadly distinguished from observational research in IMR in that they source data from relatively static individually-produced records published online, rather than using traces of (and potentially real-time) interactions and behaviours (such as web browsing activity, online discussion exchanges, etc.). Of course, this distinction can become blurred, as already noted. Though relatively few to date, compared with other methods, some examples of document analysis approaches in IMR do exist. Thus, several authors have reported carrying out analysis of blogs (Clarke and van Amerom 2008; Marcus et al. 2012). Others have carried out analysis of other types of websites (Thoreau 2006, conducted a qualitative analysis of the online magazine *Ouch!* produced by and for disabled people). One approach which has been successfully implemented is to solicit documents, rather than using existing online sources; thus, Hessler et al. (2003) in a study of adolescent risk behaviours recruited participants and asked them to submit daily diary entries online. This method was reported as being successful in generating valuable, rich data, in which participants gave candid and open responses, which the researchers comment can be hard to achieve with this population using offline ftf methods.

3. Key Issues and Debates in IMR

As has been apparent throughout the above discussion, there are a number of very

appealing advantages of IMR methods, many of which have by now been well-demonstrated across a range of methods and research topics. Some of the more salient evidenced benefits of IMR approaches which have now been well-documented include: extended geographical reach, facilitating access to a large, diverse pool of potential participants worldwide; possibilities for implementing recruitment methods which can facilitate access to hard-to-reach, specialist populations; enhanced time and cost efficiency (e.g. due to automated data input, transcription, delivery of materials and procedures, etc.). Also, possible effects leading to enhanced candour and disclosure have been highlighted, as well as other advantages such as the enhanced scope for using unobtrusive approaches which may lead to more authentic data, and enhanced data quality due to the automated checks that can be implemented, e.g. in web-based surveys. Such benefits of IMR have been noted throughout the above discussion of specific methods. However, there are also issues of concern that have been raised in relation to IMR methods. In this section some of the key concerns that have been raised are considered, with an emphasis on their likely impact in terms of creating threats to the value, quality and reliability of IMR-generated data, and possible threats to being able to implement ethically sound research studies.

3.1 Data Quality

One key threat to data quality in IMR which has been raised, particularly in relation to survey and experiment approaches, is the reduced levels of control over – and ability to monitor – the procedural aspects of a study. Thus due to the typical lack of physical proximity between researcher and participant(s), it can be difficult to control and monitor the participation context (e.g. are participants distracted, intoxicated, etc.), participant behaviours (e.g. are they multitasking, or not following procedures as instructed), and the details of presentation parameters and procedures (e.g. display variations, due to different hardware and

software, and so on). The potential impact of all these factors, and particularly the perception that in online contexts people have a propensity to not be honest and authentic in their reports and behaviours, were initially a major concern in discussions of IMR methods. However, there is now a vast collection of research data – particularly from IMR validation studies (as mentioned above) – which strongly suggests that people do give genuine, honest responses when taking part in IMR studies, and that these studies can and do generate valid, reliable data comparable with that which can be achieved in more traditional offline contexts.

Validation studies which have demonstrated that psychometric tests administered online can display properties equivalent to their offline counterparts have been already mentioned above (Anderson et al. 2003; Hewson and Charlton 2005). There are numerous additional such examples confirming the validity of a diverse range of test instruments for online administration (e.g. Brock et al. 2012; Buchanan and Smith 1999; Kosinski et al. 2003). Only a few examples have found a lack of equivalence (e.g. Barbeite and Weiss 2004; Davis 1999), and in these cases it is not always clear whether the online or offline data is superior. Beyond psychometric scales, other types of questionnaires, and experimental designs, have also been found to show evidence of validity for online administration; for example, Voracek et al. (2001) replicated sex differences in sexual jealousy which had previously been established offline. This report is of interest in relation to the common perception that (because they can) people are more likely to lie about their personal characteristics, such as sex, age, and so on. Replication of established sex differences, or indeed the effects of other demographic and individual difference factors, would seem to indicate that, at least in these cases, people are accurate in their reporting of such personal characteristics. Other authors reporting replicating in IMR experiments findings established offline include Corley and Scheepers (2002); Linnman et al. (2006); see also McGraw, Tew

and Williams (2000) for a review.

Interview and focus group methods are also potentially affected by reduced levels of control in IMR. Control over procedures (e.g. ensuring that messages can be sent and received, chat software doesn't stall mid-conversation, etc.) is important to ensure high quality data. Monitoring participants and what they are doing is generally easier in IMR interviews and focus groups than in online surveys and experiments, due to the greater presence of the researcher throughout the whole process; nevertheless, it would be possible for an interviewee to deliberately set out to deceive the researcher, for example by lying about their age, sex, ethnicity, and so on, should they be motivated to do so. The reported experiences of IMR interviewers to date does not suggest that such deception is likely to occur. Another possible threat to data quality in IMR interview research, as discussed above, is the reduction of interpersonal cues (due to the lack of direct physical proximity), possibly leading to ambiguities, misunderstandings, and generally impoverished data. However, a number of researchers have reported obtaining high quality, rich, reflective interview and / or focus group data in IMR. One factor which has been emphasised as important is the careful planning of rapport-building strategies (e.g. Jowett et al. 2011). Whilst there is some evidence that asynchronous interview approaches might be better able to generate high-quality rich, reflective, reflexive data than synchronous methods, both approaches have been reported to have been successful (e.g. Madge and O'Connor 2002).

Unobtrusive IMR methods are generally less affected by many of the factors discussed above. Control over participant behaviours becomes less relevant, for example, since unobtrusive methods are typically concerned with the observation and analysis of naturally occurring online behaviours, often using stored traces and archives of these behaviours. Also, since the focus in unobtrusive approaches is often on studying the

idiosyncrasies of online interactions themselves, as compared with offline behaviours and interactions, the unusual nature of the online medium becomes itself the focus of enquiry, rather than a barrier to be overcome. However, the enhanced scope for individuals to manipulate their identities online, particularly where this may involve hiding aspects of their offline identities and attributes (e.g. biosocial characteristics), should be borne in mind by researchers. This is particularly relevant to approaches where the authenticity of the information provided is important, such as in an analysis of the types of posts made by males and females in an online forum. Researchers using these types of unobtrusive methods should remain aware of these caveats, and take them into account when considering interpretations of data derived from online sources. In other contexts, where accurate information about factors such as biosocial attributes is less crucial, ensuring that the computational procedures (algorithms) used for accessing, storing and analysing data sources are robust and reliable, and can extract and save the required information, remains important.

3.2 Sampling

Sample bias has been a longstanding concern in IMR, early researchers noting that the inherently biased nature of the internet user population (IUP) raised serious concerns regarding the quality of data that could be obtained using IMR recruitment procedures and study administration methods (Bordia 1996; Coomber, 1997). The perception in those days of the typical internet user being a well-educated, tech-savvy, middle class, western white male was prevalent (and not necessarily without good reason). Still, there were clearly also internet users who did not fit this stereotype, even in the very early days. Today, it seems that this conception of the typical internet user certainly needs revision, and while it is generally recognised that biases still exist (e.g. towards users in developed nations), many researchers

now would find the early claims that IMR samples cannot provide useful, and reasonably representative, data untenable. Not least, the many services and functions the internet now provides to a broad, diverse population of users (as noted earlier, e.g. banking, shopping, socialising, etc.) indicates how it has permeated further and further into everyday lives over the last couple of decades. To consider the growth of the IUP over the last twenty or so years, refer to the figures presented in Table 1, which show the growth in the number of internet hosts (a host is an internet-connected computer that provides internet access to a larger number of connected computers, e.g. as in an 'internet service provider' or 'ISP', such as 'Zen Internet') and estimated numbers of internet users over the last twenty years.

Table 1: Number of recorded hosts, and estimates of the number of internet users, between 1995 and 2015.

Date	Hosts[1]	IUP (millions)[2]
1995	5	45
2000	72	430
2005	318	1094
2009	625	1825
2010	733	2030
2015	1010*	2890

[1]Hosts figures taken from the Internet Systems Consortium 'ISC Domain Survey': www.isc.org/solutions/survey (*Latest figure currently available, Jan 2014).
[2] IUP estimate figures taken from Computer Industry Almanac: www.c-i-a.com/internetusersexec.htm.

Clearly, Table 1 shows the growth in the size of the IUP to have been quite dramatic over the last two decades. Evidence for the diversification of this population, e.g. in terms of penetration worldwide, has also been presented (e.g. see the summary figures presented by Hewson and Laurent 2008). Also, the comprehensive and systematic Oxford Internet Surveys (OxIS, see: http://microsites.oii.ox.ac.uk/OxIS/) have provided valuable data on the composition and habits of the UK IUP, as part of the World Internet Project (see:

www.worldInternetproject.net/#news). For example, the 2011 report (available: http://microsites.oii.ox.ac.uk/OxIS/publications) refers to evidence of a new generation of internet users who access the internet from multiple locations and multiple devices.

Alongside the above evidence concerning the growth in size and diversity of the IUP, as well as emerging developments and trends in usage patterns, there is now also an emerging body of evidence indicating that internet-accessed samples recruited online can produce high quality data. Thus, the validation studies mentioned above provide such evidence, at least where (as in many cases) these used online recruitment methods to access internet samples. Other studies have set out in particular to compare various online and offline sampling methods. Early examples have indicated that internet-accessed samples can be more diverse than traditional offline samples on some variables (e.g. Smith and Leigh 1997). That said, often these studies (many being examples from psychology) have used undergraduate psychology students in their offline recruitment methods, which are not themselves especially diverse. More recently, however, systematic investigations drawing upon broader types of samples have been implemented, offering some very valuable insights. One such study, carried out by Malhotra and Krosnick (2007), compared a large scale, offline (face-to-face) probability sample with a non-probability volunteer internet sample; the internet sample was recruited from an online panel, using stratification to match to population parameters. Administering a survey on voting behaviour and attitudes, these researchers found evidence that the offline sample data was superior, and that the offline sample better represented the (US) population at large on key parameters. Other researchers, however, have reported finding that online volunteer samples can generate data comparable to that obtained from offline probability samples (e.g. Miller et al. 2010), while others still have shown that online probability samples can be obtained which display good levels of broader generalisability

(e.g. Chang and Krosnick 2009). It seems that contexts where generalisability to a broad (e.g. national) population is crucial may be most at risk from issues related to biases in internet-accessed samples. However, where access to probability samples can be achieved, e.g. by use of a panel recruited using offline probability sampling methods, these risks may be lowest. Contexts comparing internet-recruited volunteer samples with offline non-probability samples have typically found the online data to be at least as good quality as the offline data (e.g. AbuAlRub 2006; Gosling et al. 2004).

Of course, as indicated in the above discussion, the types of online recruitment methods used to access internet samples will play a key role in determining the types of samples obtained, including in terms of their demographics and other characteristics. It is beyond the scope of this chapter to review the range of methods available in further detail, but a comprehensive account can be found in Hewson, Laurent and Vogel (forthcoming 2014).

3.3 Ethics

IMR methods and approaches, particularly some of the more recent unobtrusive methods that take advantage of the wealth of traces of online activity now available, have raised some tricky ethics issues. On the one hand, there can be issues involved in properly porting existing ethics principles and practices to an IMR context; on the other, new issues and challenges may emerge. Some of the issues which IMR procedures raise can be non-obvious to the researcher accustomed primarily to standard ethical practice in the context of traditional offline research (BPS 2013). Though that is not to suggest that the same ethics principles and practices should not also apply in IMR. The recent BPS guidelines on ethics in IMR (BPS 2013) outline some of the key issues to emerge. As well as issues such as how to properly implement informed consent, debrief and withdrawal procedures (e.g. how can you

verify online that a participant consenting to answer a web survey is over 16, or whatever the recommended required minimum age is in order to be able to give valid informed consent in other ethics guides), new issues which arise are discussed. One such key issue which has been debated in the IMR literature is that of the nature of the public-private domain distinction online. In particular, leading to (yet unresolved) questions concerning when it may or may not be acceptable to undertake observation (particularly non-disclosed) of people's online activities which have become readily accessible through the ways in which traces are recorded, stored and archived online. Thus, for example, the ready access to many archives of online discussion forums posts via Google Groups was mentioned previously. It is not always clear in what circumstances it is ethically justifiable for a researcher to access and use such posts as sources of research data. Indeed, there has been widespread disagreement and contrasting practice on this issue in the history of IMR. The BPS (2013) guidelines offer some useful advice on this and other key ethics issues related to IMR methods and procedures.

To illustrate the ongoing disparities in both opinions and practices relating to the issue of the use of readily accessible data traces online, as well as the related issue of disclosure and whether usage of such traces should be overt or covert, consider the following contrasting examples. Fox, Ward and O'Rourke (2005) adopted a strategy of full disclosure in a study in which they followed discussions on a pro-anorexia website; they disclosed their intentions as researchers, and participated in discussions on the website's message boards. Brotsky and Giles (2007), on the other hand, also carried out a similar participant observation study involving pro-anorexia discussion and support websites, but without disclosure. In this case, one researcher posted as a plausible persona on the website, and engaged in interactions with it's users, in order to gather research data. In each case the researchers presented

arguments to back up their design choices, and justified these in terms of their ethical appropriateness; also each study was approved by a research ethics committee (REC). It is the similarity of these two studies, alongside their very different stances on whether disclosure was appropriate, which is striking. Another interesting illustration comes from Tackett-Gibson (2008) who intended to engage in full disclosure of a research study which set out to observe online communities engaged in exchanging drug use information; however, this intention was blocked by the group moderators who were only prepared to give permission to lurk and carry out observations unobtrusively (as well as have access to stored discussion archives). Arguments that disclosing research intentions might sometimes serve to disrupt or damage a group are relevant here, and moderators may often be in a good position to offer advice on this point (so contacting them first is generally good practice).

One study which directly addressed the issue of disclosure in online observational research is presented by Hudson and Bruckman (2004), who carried out an experimental study in which they observed the responses of chat room participants to disclosures of observation intent by researchers (recording the discussion), compared with undisclosed entry and lurking. In both cases hostile responses were encountered, but the researchers report being kicked out less often when merely entering and lurking. While this result is interesting, it should be noted that the researchers engaged in no attempt to build any type of rapport with participants (as has been found to be a good strategy in interview approaches, as discussed above). Indeed, their observation announcement ("We are researchers recording this chatroom for a study on language use in online environments. For questions or comments, email study@mail.chatstudy.cc.gatech.edu. Thank you!") may rather have been perceived as intrusive and abrupt.

In relation to the above discussion, and the difficulties that can sometimes emerge

when trying to make ethically sound decisions about appropriate IMR procedures and practices, perhaps a useful principle to bear in mind is that from the BPS (2013) guidelines, which recommend that a researcher should "ensure that ethics procedures and safeguards are implemented so as to be proportional to the level of risk and potential harm to participants." (BPS 2013:8). For other useful guidelines on ethics in IMR see: the 2012 report of the Association of Internet Researchers (AoIR: http://aoir.org/reports/ethics2.pdf); Buchanan and Ess (2009). These guides offer advice on important issues, such as how to maximise the effectiveness and reliability of informed consent, debrief and withdrawal procedures in IMR; how to ensure confidentiality and anonymity of data; legal issues, including copyright and data protection laws; considerations relating to sensitive research topics, and conducting research with minors.

4. Future Possibilities and Directions in IMR

This is an exciting period in the development of IMR methods. As noted above, changes in the way people are using the internet (e.g. the new generation of mobile users) and the integration of internet technologies into our everyday lives (e.g. in learning, socialising, travelling, exercising, shopping, etc.) are creating all sorts of imaginable opportunities for incorporating these developments to inspire creative, new IMR techniques and approaches. Thus, we might imagine incorporating multimedia information (pictures, videos, audio recordings) into survey and interview methods, not just in presenting materials to participants (as has already been done), but also in determining the way participants can respond. Geolocation data could also be incorporated, allowing tracking and recording of a participant's movements during a study procedure. Such approaches could allow richer and more detailed data to be collected (perhaps supporting visual methods, which have been of recent interest in social research, Bagnoli 2009, or 'walking interviews', see Jones et al

2008). The scope for implementing in-situ procedures, in which participants are immersed in particular contexts relevant to the research study, expand with such possibilities. Early innovators have already started to explore such creative applications, using a range of internet technologies, including social media sites, and mobile 'apps' (a software application designed to run on smart phones, tablets, and such devices). One example is the project 'mappiness', based at the London School of Economics (homepage: http://www.mappiness.org.uk/) which aims to map happiness across the UK, and examine how people's happiness may be affected by their local environment. Participants are provided with a smart phone app to download (iphone only), which bleeps every day to ask how they are feeling, as well as record their location, and some other information (such as who they are with). The app also allows a photograph to be uploaded, to show the current location. The findings from this project, so far, are reported as indicating that happiness is greater in natural environments (blog.mappiness.org.uk, accessed 22nd July 2014).

Observational research in IMR was noted above as one of the major areas of development and expansion in recent years. The anticipated increasing integration of the internet – and the 'internet of things' (internet-connected everyday objects, such as cars, fridges, televisions, running shoes, hospital beds, and so on) – into a vast number of people's everyday lives opens scope for further enhancing observational IMR in all sorts of ways. Of course, as already highlighted, ethics considerations (relating in particular to the aforementioned public-private domain distinction) emerge in relation to such possibilities. One illustrative example of observational IMR is the "we feel fine" project (Jonathan Harris and Sep Kamvar; homepage: http://wefeelfine.org). This project collects large volumes of observational data, unobtrusively, from blog posts worldwide. These data provide a live feed (updated every minute) of human emotional expressions, available to view in various

summary presentation formats from the project homepage. Other examples were offered above. As the internet-connectedness of everyday objects continues to expand, and the population of users interacting on social media and other internet sites also expands, such approaches will no doubt be facilitated and opportunities enhanced. Observational data, where ethically viable, could also be combined with other sources (e.g. from surveys, or interviews) in a mixed- or multi- method approach. The possibilities for obtaining extremely large data sets, facilitated by the ever-expanding data trail of people's online interactions and communications, is of particular intrigue. One existing example of a project which has generated an extremely large data set, in an obtrusive questionnaire-based research design, is the 'mypersonality' project (http://mypersonality.org/wiki/doku.php?id=start). This project uses a Facebook application which allows users to take psychometric tests, repeated at regular intervals, so that the data can be used to examine how responses change, or remain consistent, over time. At the time of writing the project website reported that nearly 7.5 million people had used the application to complete a questionnaire.

The rapid pace of development of internet technologies will continue to open up opportunities in IMR. Already mentioned above was the likely facilitation in the very near future of approaches involving real-time multimedia interactions online, as internet connection speeds and software and hardware technologies continue to improve (for example, fibreoptic broadband is now becoming widely available, at a reasonable cost, in the UK). Skype-type interviews may very well be a real, reliable possibility within a few years time. Other technologies which hold intriguing potential, and have already started to be used in IMR, include virtual reality environments (VREs), as discussed above. It is now around two decades since the first IMR studies started to appear. It is intriguing to imagine all the possible ways in which IMR methods, and the rapidly evolving technologies supporting

them, might develop over the next two decades. Some speculations about some likely future directions have been offered above. The work of researchers who continue to pilot innovative new techniques and methods will shape what the future holds.

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